

Gene Regulation and Epigenetics (I002621)

Course size *(nominal values; actual values may depend on programme)*

Credits 3.0

Study time 90 h

Course offerings and teaching methods in academic year 2026-2027

A (semester 2)

English

Gent

lecture

independent work

seminar

Lecturers in academic year 2026-2027

Kyndt, Tina

LA25

lecturer-in-charge

Offered in the following programmes in 2026-2027

crdts

offering

[Master of Science in Bioinformatics\(main subject Systems Biology\)](#)

3

A

[Master of Science in Bioscience Engineering: Cell and Gene Biotechnology](#)

3

A

[Exchange Programme in Bioscience Engineering: Cell and Gene Biotechnology \(master's level\)](#)

3

A

Teaching languages

English

Keywords

Eukaryotic gene regulation, epigenome, DNA methylation, histone modifications, gene silencing, chromatin, paramutation, imprinting, stress responses, signal transduction

Position of the course

In this course various mechanisms that influence gene expression and protein production in eukaryotes will be discussed: chromatin configuration, DNA methylation, RNA based gene silencing. The importance of gene regulation for the normal development of organisms will be highlighted. The dynamic response of a cell upon influences by the environment (stress responses, signal transduction) will be explained.

Contents

1. Background
2. Transcriptional regulation and translational regulation
3. Epigenetic mechanisms
 - a. DNA methylation
 - b. Chromatin-based epigenetic mechanisms
- c. Gene silencing: small and long non-coding RNAs (PTGS and TGS)
- d. uORFs
4. Regulation at the post-translational level: signal transduction
 - a. Stimuli - receptors
 - b. Messengers
5. Role of epigenetic regulation during development
 - a. examples in animals (parental imprinting)
 - b. examples in plants (transposable elements, paramutation, vernalisation)
6. Role of gene regulation during stress and disease
 - a. cancer, medical diagnostics
 - b. abiotic and biotic stress in plants
7. Seminar on Ethics by guest lecturer

Initial competences

Basic knowledge biochemistry, molecular biology, gene technology

Final competences

- 1 Have insight into the complex gene regulatory networks in eukaryotic organisms.
- 2 Understand and explain the role of gene regulation in normal biological processes.
- 3 Explain which disturbances of gene regulation occur during disease and stress responses in various eukaryotic organisms
- 4 Discuss and evaluate scientific literature about epigenetic processes.
- 5 Critically analyze the ethical aspects concerning the described techniques.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Seminar, Lecture, Independent work

Extra information on the teaching methods

This course involves oral lectures, 2 live discussions and 2 guest seminars. Presence is obligatory for the guest seminars and for at least 1 live discussion session.

The students will subscribe in a group (4-5 students per group) and read two provided scientific articles related to epigenetics. These manuscripts have to be critically assessed and discussed via UFORA. A live discussion session with the other group is organized, starting with a short presentation.

A recommended handbook as well as the slides are distributed for free via UFORA.

Study material

Type: Slides

Name: slides Gene regulation & Epigenetics

Indicative price: Free or paid by faculty

Optional: no

Language : English

Oldest Usable Edition : slides Gene regulation & Epigenetics 2024

Available on Ufora : Yes

Online Available : Yes

Available in the Library : No

Available through Student Association : No

References**Course content-related study coaching**

by email or personally (after the class or on appointment)

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment with open-ended questions

Examination methods in case of periodic assessment during the second examination period

Written assessment with open-ended questions

Examination methods in case of permanent assessment

Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible

Extra information on the examination methods

NPE: assignment: + participation : 20%

PE: written exam: 80%

Calculation of the examination mark

Students who eschew one or more parts of the evaluations for this course unit can no longer obtain a pass mark. Should the final mark be higher than 10/20, it will be reduced to the highest fail mark (9/20).